NASA Ames Research Center
NNA12374362-ACR

Acquisition Update #2

Projects and Engineering Support Services (PESS)

The purpose of this update is to inform industry of the re-structured Statement of Work "SOW", based on the pre-proposal conference.

The CORE will require a minimum engineering capability that can be flexible, responsive, and comprehensive to support the various research missions outlined in Section 3.0, *Description of Project and Engineering Functions*.

The IDIQ will consist of all sections throughout the SOW.

Please address any comments or questions to:

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NOTE: Information about major upcoming ARC procurement actions is available at: http://ec.msfc.nasa.gov/cgi-bin/eis/admin/admin.cgi?center=ARC

Attachment J.1 (a) 1

Project and Engineering Support Services

Statement of Work

June 7, 2012

National Aeronautics and Space Administration

Ames Research Center

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1.0 Introduction

The Project and Engineering Support Services (PESS) contract will support NASA Ames Research Center (ARC) for all flight and mission projects, and all advanced engineering capabilities needed to support the research and development (R&D) mission of the Center. For flight and mission projects the PESS contract will provide engineering support for all phases of engineering and project management in a project life cycle as defined in NASA Procedural Requirement (NPR) 7120.5.

Contract support will primarily be performed on-site at ARC; however, there may be some instances when work will be performed off-site, such as at other NASA centers, other Government agencies, commercial facilities, and other international facilities.

The project life cycle is briefly described below

Research and Development (R&D)

> During R&D, a team or individual will assess various possible technical solutions to a current or upcoming NASA engineering need. These will be driven by the long-term goals of one of the NASA Mission Directorates. Basic conceptual and applied engineering analysis, prototyping, and 'bench-top' engineering will be performed to determine viable technical approaches and systems-level technology assessments. Publication of these results in NASA technical documents, or as papers in an appropriate professional organization's journal or conference proceedings is typically a final result of the studies.

Pre-Phase A *(Concept Phase)*

> During Pre-Phase A, a pre-project team studies a broad range of mission concepts that contribute to program and Mission Directorate goals and objectives. These advanced mission design studies, along with interactions with customers and other potential stakeholders, help the team to identify promising mission concept(s) and draft project-level requirements. The team also identifies potential technology needs (based on the best mission concepts) and assesses the gaps between such needs and current and planned technology readiness levels. These activities are focused toward a Mission Concept Review and Key Decision Points (KDP) A.

Phase A (*Concept & Technology Development*)

> During Phase A, a project team is formed to fully develop a baseline mission concept and begin or assume responsibility for the development of needed technologies. This work, along with interactions with customers and other potential stakeholders, helps with the baselining of a mission concept and the program requirements on the project. These activities are focused toward System Requirements Review (SRR) and System Definition Review/Preliminary Non-Advocate Review (SDR/PNAR) (or

Mission Definition Review (MDR/PNAR)). The SRR and SDR/PNAR process culminates in KDP B.

Phase B (*Preliminary Design & Technology Completion*)

During Phase B, the project team completes its preliminary design and technology development. These activities are focused toward completing the Project Plan and Preliminary Design Review (PDR)/Non-Advocate Review (NAR). The PDR/NAR process culminates in KDP C.

Phase C (*Final Design and Fabrication*)

During Phase C, the project completes the design that meets the detailed requirements and begins fabrication of test and flight article components, assemblies, and subsystems. These activities focus on preparing for the Critical Design Review (CDR) and the System Integration Review (SIR). This phase culminates in KDP D.

Phase D (*System Assembly, Integration and Test, and Launch*)

During Phase D, the project performs system assembly, integration, and test. These activities focus on preparing for the Flight Readiness Review (FRR). This phase culminates in KDP E.

Phase E (*Operations and Sustainment*)

During Phase E, the project implements the Missions Operations Plan developed in previous phases. This phase culminates in KDP F.

Phase F (*Closeout*)

During Phase F, the project implements the Systems Decommissioning/ Disposal Plan developed in Phase E, and performs analyses of the returned data and any returned samples.

2.0 Scope of Work

Due to the R&D nature of NASA's missions, the scope of work outlines the functioning of the contract and should not be regarded as definitive representations of future research support requirements.

The Contractor shall be responsible for providing a minimum engineering CORE capability that can be flexible, responsive, and comprehensive to support the various research missions. The CORE capability shall provide the support outlined in Section 3.0, *Description of Project and Engineering Functions*, that will be necessary to support the various missions during the different project life

cycle phases and shall adjust within the established Estimated Cost Plus Fixed Fee (CPFF) (See Section B.1, (c)) of the contract. Individual Contract Task Orders (CTOs) (See Section B.1, (d)) will be issued to supplement the CORE capability when required.

The CORE and each CTO will have defined requirements (such as deliverables, significant milestone dates, and established performance measurement criteria. The Contractor shall work closely with the Contracting Officer (CO) and the Contracting Officer's Representative (COR) to ensure that the Contractor is meeting the minimum CORE capability with the estimated CPFF. CTOs will be also utilized to address any other direct costs (ODCs) not covered by the CORE capability.

The Contractor shall assure the availability of qualified personnel and resources for timely response to performance under the CORE and CTOs. For requirements performed under the CORE and CTOs, technical progress and resource expenditures shall be reported monthly by the Contractor to the Government (See Section J.1(a), Attachment J.1(a)3, Data Requirements List.

The Contractor shall provide a Task Plan for each assigned CTO or CTO modification with the following information:

- A discussion of the approach for performing the work, including technical approach, risk assessment, and any ancillary deliverables defined by the Contractor (if required).
- Milestone Schedule.
- An estimate of labor hours and skill mix by applicable labor category, extrapolated on a monthly basis.
- The total estimated cost and fixed fee for completion of the CTO, including:
- Direct Labor Hours.
- Direct Labor Cost.
- Other Direct Costs (ODCs) including, but not limited to materials, equipment, travel and subcontracting.
- Indirect Costs.

3.0 Description of Project and Engineering Functions

The Programs and Project Directorate (hereafter, referred to as Code P) is part of the NASA Ames Research Center. Code P performs Program and Project management, control and tracking in support of NASA space missions and other Government projects. The Engineering Directorate (hereafter, referred to as Code R or the Directorate) is part of the NASA Ames Research Center and the principal engineering organization for aerospace systems and spaceflight projects.

Code R work includes innovative engineering; designing, developing, manufacturing, assembling, and operating complex mechanisms; avionics; materials research; instruments; and systems in support of NASA missions and other Government projects. This

procurement is for research, engineering, development and technology infusion support services to assist that effort.

The Directorate performs the engineering systems support for spaceflight, airborne, and ground-based systems at Ames supporting the Agency's work in the Aeronautics Research Mission Directorate (ARMD); the Science Mission Directorate (SMD); the Office of Chief Technologist (OCT); and the newly formed Human Exploration and Operations Mission Directorate (HEOMD).

Programs supported by the Directorate include the Small Spacecraft Technology Program in OCT; Airborne, Space and Earth Science instruments, Discovery-, Explorer-, and Venture-class Projects, and mission operations for SMD; evolving advanced space technology projects and advanced systems development in OCT; Advanced Exploration Systems, Human/Robotic systems, Bioengineering and other capability-driven programs being developed in HEOMD; the Center's Innovative Small Sat Research projects, in addition to a variety of NASA inter-center work agreements (e.g. with JSC, KSC, and MSFC) for the Directorate to provide specialized engineering systems and technical support.

Laboratories, cleanrooms, shops and engineering facilities are operated by the Directorate in support of the Projects being done at the Center. Code R maintains strong relationships with other U.S. Government agencies, industrial organizations, and academic partners for the purposes of joint engineering research, development, and technology collaborations.

Codes P and R are composed of Project and Engineering Divisions, each with expertise to support the above-listed Mission Directorates at specific phases of a systems lifecycle. The engineering services and capabilities currently emphasized are described in sections 2 and 3 of this Scope of Work. Example Projects are described in section 3 of the Scope of Work and may include participation across multiple engineering groups, divisions, and directorates. The contractor may be required to perform at locations other than Ames Research Center.

The functional requirements to be performed are described in the following sections.

3.1 Contract Management

The Contractor shall provide overall management and administrative functions to ensure that the proper resources are available and allocated, that required reports and documentation are prepared, and that the overall environment supports the research requirements. The Contractor shall perform the following:

(1) Manage the contract in a fiscally responsible manner, fulfilling all requirements of negotiated CTOs.

(2) Provide a well-defined, stable organizational structure with clear lines of authority and clearly identified interfaces to the Government.

(3) Provide secretarial and financial services for their employees.

(4) Provide staff with training in state-of-the-art engineering and information technologies.

(5) Comply with Government policies and regulations including the Ames Management System (AMS) and relevant AMS policies (See Section 4.0.)

(6) Manage the resources allocated by NASA for specific tasks in a manner to ensure research goals are reached in accordance with agreed upon milestones.

(7) Develop, implement and maintain a discrepancy reporting and tracking system. Discrepancy reports may be issued by the Contractor as well as by NASA regarding technical, resource or financial issues that may prevent meeting milestones or the performance of the task. The system shall assure that all discrepancies are documented and resolved. Discrepancy histories shall be reviewed for indications of systematic or recurring problems that need improvement.

(8) Provide a monthly report of the state of all tasks, identifying accomplishments, publications, and major milestones reached. Identify problems and concerns over issues that may affect contract performance along with the recommended solutions.

(9) Provide property management to ensure accountability for installation- provided equipment and facilities and maintain responsibility for annual inventory surveys and accountability verification forms.

(10) Provide a risk management approach that will be used to ensure that the Government has adequate insight into the risks associated with the Contractor's ability to accomplish tasks outlined in any CTO.

Each task shall have a Task Manager who shall be the primary point of contact with the Task Requester.

3.1.1 Shift and Hours of Work

Most services associated with this SOW shall be performed on-site on the first shift, but second and third shift support may also be required. There may be occasional requirements to work weekends and/or holidays. Requirements for services to be performed beyond the normal work schedule will be coordinated between the COR and the Contractor prior to their performance. NASA Civil Servants have an option to work an alternate compressed schedule. This option will be made available to the Contractor provided that the cost and services are not affected.

3.2 Technical Task Support

It is anticipated that the Contractor staff shall perform the following functions as required on a per task order basis:

(1) Collaborate and exchange technical information with the Government research and engineering staff in order to meet the requirements of each CTO.

(2) Provide engineering support on a task-by-task basis, including direct engineering functions and indirect support such as technical and programmatic reviews.

(3) Provide short turn-around deliverables for specific project milestones as needed and within the time frame outlined in the approved CTO.

(4) Conform to all relevant standards and practices (configuration management, system integration requirements, etc.) for all projects and deliverables as defined by the NASA Ames Research Center.

(5) Support technology infusion/deployment efforts with NASA customers.

(6) Attend and participate in group and project meetings.

(7) Present research, engineering work in progress, and results to civil service management and at conferences.

(8) Support (occasionally short-notice) preparations for demonstrations and presentations of project engineering, work in progress, and results to visitors and technical delegates, including supporting and/or hosting of technical workshops as needed.

(9) Travel as needed to conferences, field sites, universities, and other agencies in the performance of research, integration of products, technology infusion, and other important demonstration of results.

(10) Acquire resources (equipment, furnishings, and supplies) needed to support the successful completion of all CTO and related work.

3.3 Project Management and Support

NASA Ames requires Project management for space systems and spaceflight, airborne, and ground-based projects. The project management support services are in accordance with APR 7120.5 and NPR 7120.5 unless otherwise specified in the CTO. Project management functions shall include coordinating and directing all resources necessary to meet the technical, schedule and budget requirements of each CTO. Key project management activities include the following: early project planning and

proposal development; creation of project documents such as Project, Configuration Management and Risk Management Plans; development of project work breakdown structures and cost estimating; schedule development, management, tracking and earned value management; development, use and maintenance of information tools and systems for monitoring project performance; technical and administrative support for presentation package development and presentation for all types of project reviews such as Preliminary Design Reviews, Critical Design Reviews and various types of Key Decision Point Reviews; the development of documents such as test and integration procedures, hardware contamination plans, test reports and lessons learned summaries; technical writing support for the preparation of technical papers, manuals and engineering reports; logistics support for project activities; and procurement support and technical oversight for project systems and subsystems as required.

3.4 Mission Design R&D, Pre-Phase A and Phase A

Code P and Code R conduct early-stage concept development and technology maturation supporting the Center's space and aircraft mission proposals. Personnel have experience in generating proposals, designing spacecraft busses in support of instruments, and designing instruments in support of science objectives

The principal activities are encompassed by the following three topic areas.

3.4.1 Mission Design Tools and Capabilities

The NASA Ames' Mission Design Center (MDC) provides concurrent engineering facilities and software for rapid mission development and analysis. The MDC is staffed by subject matter experts covering the domains required to fully develop successful spacecraft mission concepts. The MDC staff use and develop design tools supporting the full mission, including for example, orbit / trajectory design, thermal and electrical analyses, avionics and guidance, navigation and control design, development of operations concepts, and costing. The MDC facilities and staff conduct scheduled and rapid-response design cycles to develop initial mission concepts into proposal-ready, fully supportable technical packages.

3.4.2 Technology Incubators

Low technology readiness level (TRL) hardware or software that promises to be mission-enabling, transformative, or disruptive often requires a period of incubation or R&D during which it can be developed in an unfettered environment sufficiently to determine if the technology is worth a larger investment. The Directorate provides this opportunity for engineers and scientists to engage in basic development work with a minimum of "red tape". Contractor participation in this activity potentially spans all aspects of technology creation and maturation.

3.4.3 Proposal Development

A key role for the MDC is creation, leadership and support of proposals. These may be in response to NASA or other agency solicitations, or developed by the Center as

unsolicited proposals. Directorate staff may serve as capture lead, principal investigator, project manager, or in a variety of other supporting roles as appropriate to the proposal. Staff provides technical and programmatic input throughout the course of proposal development, as well as editorial and graphics support.

3.5 Engineering Systems (Some R&D, and Phases B, C and D):

The major functions of the Engineering Systems elements of the Directorate are the design and development of spacecraft and project systems (both hardware and embedded software), ground systems and ground support systems. Once a project has either been selected from a formal proposal or directly funded, a project team is formed, and staffed by Code R's engineering team, and project managers in Codes R or P. This engineering team is generally comprised of both civil servants and contractors who work together to define requirements; define the technical processes and procedures they will follow throughout the project; perform risk identification, mitigation and management; complete trade studies, designs and analyses; specify materials and equipment; write statements of work or specifications for subcontracts; write test plans and procedures; oversee fabrication, integration and testing; and perform verification and validation to the project's technical requirements. The engineering team may also design and develop prototypes, test fixtures, and ground support equipment and perform testing on both flight systems and prototypes. Some engineers may also work in the Multi-Mission Operations Center (MMOC) during Phase E. The engineering effort includes the engineering disciplines necessary to design, build, test and operate a spacecraft.

3.5.1 Integrated Engineering Services (Systems, Mechanical, Electrical, Avionics, Bio-, and Thermal Engineering)

A recent example of such an effort was the development of the LADEE (Lunar Atmospheric and Dust Environment Explorer) spacecraft. The work involved the design and development of the spacecraft, an instrument (Ultra-Violet Spectrometer), and ground support equipment. The systems engineering effort followed NPR and APR 7123.1A and included interface management and overall coordination of the technical effort. The mechanical engineering work included the design of the spacecraft structure utilizing composite materials, and testing and performing various analyses on the structures, materials and fabrication techniques to verify requirements would be met by the design. The work also involved the design and analysis of the thermal control system to maintain the proper temperatures in the spacecraft and instruments throughout the mission. Electrical power designs included the design and analysis of the electrical grounding scheme; the design and analysis the solar array types and their placement on the structure to ensure maximum power during the various phases of the mission; specification, selection and oversight of many subcontracts including the Command and Data Handling Unit, Inertial Measurement Unit, Power Supplies, and Propulsion System. Both peer reviews and milestone reviews were held to both in-house and external

reviewers. The engineering effort included performing various tests on materials, parts, components, subsystems, and systems (spacecraft, ground system, and instrument) as well as ensuring all documents and drawings represented the as-built system.

Codes R and P typically support over 50 projects at a time in support of NASA's spaceflight, airborne and ground-based research. Projects and tasks may include the development of an airborne instrument, design of a micro or nano-satellite bus, design of a wind tunnel model, development of a space-ready biological/chemical payload or instrument, design of a instrument for a researcher, design of a microprocessor-based control system, including embedded software development, performing a finite element analysis on an airship structure, launch vehicle or ground-based centrifuge, performing cryogenic analysis and designs for both ground-based and spaceflight liquid cooling systems, evaluation of equipment survival at low and high temperature extremes, and development of biological payloads for the International Space Station and other missions.

3.6 Advanced Manufacturing, Testing, and Operations: (Some Pre-Phase A, and Phases C, D and E):

3.6.1 Fabrication and HW Prototyping Services

Code R provides hardware development, fabrication and engineering testing services to support NASA, Ames, Academia and Private Industry research needs. R offers project management, consulting and estimating services for fabrication, assembly, and testing of hardware. R specializes in assisting scientists and engineers develop their needs into concepts, prototypes, and finalized hardware. Code R staff consists of highly skilled civil servant and contract technicians responsible for evolving abstract ideas into tangible hardware for aeronautics, space flight and the advancement of science. The work spectrum includes manufacturing specialized complex designs utilizing unusual processes, specialized equipment and/or techniques, challenging tolerances from detailed drawings and fabricating highly complex aerospace hardware to generally defined (no finished drawings) work that is extremely unique and novel. Work is accomplished through AS 9100 processes and procedures.

Ames' manufacturing capabilities consist of four functional areas including Advanced Machining, N/C Programming, Mechanical Instrumentation and Inspection. In these areas hardware is developed, manufactured, fabricated, inspected, and tested. Items range from miniature ballistic models to spacecraft flight hardware. Ames' model makers have a comprehensive understanding of the latest techniques, procedures and materials to ensure that hardware is manufactured to the highest standards.

Ames' Fabrication capabilities consist of three functional areas including Nonmetallic Fabrication, Structural Fabrication and Light Sheet Metal. In these

areas hardware developed and manufactured ranges from carbon graphite composite space flight hardware, light sheet metal for aircraft and spaceflight systems, to structural elements for full-scale wind tunnel models. Model makers have vast experience and knowledge and understand the strengths and weaknesses of different methods of manufacturing and are often consulted by the customers for recommendations to optimize the development process.

3.6.2 Engineering Evaluation Laboratory (EEL) and the Flight Processing Center (FPC) Integration and Test Services.

The EEL and FPC are currently maintained solely by contractor staff.

The Engineering Evaluation Laboratory (EEL) provides engineering test and evaluation capabilities at the proto-type, proto-flight, qualification, and certification levels. The EEL has vast testing resources, and whenever those are not sufficient, the staff will typically invent a methodology to provide the required data. The EEL staff shall have vast knowledge in the areas of structural strength, verification, fatigue testing, monitoring instrumentation, strain gauging, dynamic data acquisition and analysis, modal and spectral analyses for stationary and rotating systems, and loading tests of components and structures. The types of adaptive test engineering employed by the EEL vary from improvising electronic instrumentation, including Labview software development, to manufacturing unique hardware needed to acquire the appropriate data.

The Flight Processing Center (FPC) provides and maintains facilities, equipment and supplies required to carry out integration and test functions for Center projects. Facilities include an environmentally controlled Class 100K (ISO Class 8) High Bay clean room, two Class 10K (ISO Class 7) clean room facilities used for flight system assembly, integration, test, and handling, Prototype-flight fabrication and assembly areas for electronics and mechanical systems, satellite assembly and test areas, science laboratories, test laboratories, bonded storage, a warehouse facility, the Multi-Mission Operations Center (MMOC-1), project office space, conference rooms, hardware development labs, science laboratory space, and off-line assembly areas. Equipment includes general and specific GSE and tools, test equipment, overhead cranes (5 and 1.5 ton cap.), and data systems. Supplies include consumables and equipment associated with FPC operations for clean rooms, shipping and receiving, office and administration, assembly and test, and general facilities operations and maintenance.

The FPC manages a 14,000 sq. ft. bonded storage facility for both flight and ground hardware, equipment, and materials. The FPC, in cooperation with the Multi-Mission Operations Center (MMOC), can provide integrated mission operations and ground data systems interfaces associated with ground testing of flight systems within the FPC facility.

FPC management and staff provide many years of experience and expertise in flight system development, integration, test and processing for NASA research and flight missions. The FPC facilities provide the essential capabilities and environment to successfully develop, test, and process hardware systems to meet instrument, spacecraft and payload requirements in all phases of development. FPC provides flight proven expertise, processes and procedures in assembly, integration & test, document control, configuration management, bonded stores, material control, ground handling, shipping and logistics, contamination control and laboratory protocols. The FPC provides project assistance with scope of work planning and estimating, Integration & Test (I&T) proposal contributions, and the acquisition of special skills as needed.

3.6.3 Multi-Mission Operations Center (MMOC)

The Ames Multi-Mission Operations Center (MMOC) enables and supports flight and science operations for Ames spaceflight missions. The MMOC is composed of the facilities, networks, IT equipment, software, and support services needed by flight projects to effectively and efficiently perform all mission functions, including planning, scheduling, command, telemetry processing, and science analysis.

The MMOC facilities and data systems are FISMA-compliant and were granted authority to operate in September 2011. The facilities include two general-purpose Mission Operations Centers (MOC-1 and MOC-2), the Kepler Science Operations Center (KSOC), and the SOFIA Science Center. The MMOC also coordinates the maintenance and up-keep of two space-to-ground communications antennas: a 13-meter Geo-Track and a 9-meter Leo-Track. The current capacity of the MMOC ranges up to four simultaneous missions, dependent upon mission size and complexity, and resources exist to support future expansion.

Missions utilizing the MMOC have access to voice loops connecting all NASA flight centers. Live video streams from launch operations at the Cape and from the International Space Station are also available. Data processing capabilities include telemetry and science data handling, storage, distribution, and archiving. Telemetry and science data can be distributed real-time via secure, dedicated network links. Select data can also be made available via the Internet. The MMOC enables ground data systems interfaces to ground support equipment, including hardware-in-the-loop simulators. When required, the MMOC can implement system redundancy to achieve high operational availability.

The MMOC is configurable to support use of the software tools that each mission requires. Command and telemetry handling software deployed in the MMOC include ASIST and ITOS, but any similar application can be accommodated. Currently, the MMOC is implementing the GMSEC modular software architecture so that various command and telemetry applications can be easily plugged in.

Mission support services performed by the MMOC staff include administration and maintenance of all mission IT equipment and databases and network engineering to

define and activate connections not only to the spacecraft, but also to mission partners at other NASA centers, in industry and in academia. Physical and IT security is monitored and enforced to protect mission resources, both equipment and data. MMOC engineers perform deployments of COTS and in-house software and maintain stringent configuration control over mission IT resources to ensure the reliability, consistency and robustness of the deployed systems. The MMOC also provides project support to missions through meeting and review participation and documentation development.

4.0 WORK QUALITY

In support of CTOs issued, the Contractor shall comply with the technical and management process requirements of the Ames Management System. This includes following applicable Ames' procedures that are subject to audit and preparing for and participating in process audits as required by Center and Agency authorities. The Contractor shall attend relevant training, provided by the Government, as required for all on-site employees. Specific procedures will be indicated on each task order response. These procedures may include, but are not limited to, the following AMS documents:

NPD 1280.1 APR 1280.1 NPD 8730.5

NASA Management Systems

Ames Management System (AMS) NASA Quality Assurance Program Policy

The Ames' Quality System documents can be found at: http://ams.arc.nasa.gov

The Government's Safety and Mission Assurance organization or its established QA contractor provides formal Quality Assurance (QA) oversight.

5.0 DELIVERABLES

Products and services requirements shall be defined in each task order.

6.0 PHASE-IN/PHASE-OUT

Phase-In: The phase-in process shall be accomplished as expeditiously as possible, with a maximum phase-in period of 30 days. The phase-in process shall not adversely impact the work being done by the outgoing contractor. It shall be conducted in a manner consistent with safe operation requirements. The incoming contractor is responsible for providing a qualified contractor staff by the end of the phase-in period.

Phase-Out: Upon completion of this contract, the outgoing contractor is responsible for the orderly transfer of duties and records to the incoming contractor. This should be

accomplished in an expeditious manner, consistent with any contract phase-in schedule, while minimally impacting ongoing task orders. The contractor shall submit a phase-out plan no later than 60 days before the end of the contract for Government review and approval.

Appendix XX: NASA Ames Research Center's Engineering Directorate organization

The contractor will provide support to all ARC Directorates; however, those listed below will be primary users.